BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF HAWAI‘I

In the Matter of PUBLIC UTILITIES COMMISSION Instituting a Proceeding To Investigate Integrated Grid Planning.	DOCKET NO. 2018-0165

HAWAIIAN ELECTRIC COMPANIES'
MOTION FOR CLARIFICATION AND/OR
PARTIAL RECONSIDERATION OF ORDER NO. 38482

MEMORANDUM IN SUPPORT OF MOTION

EXHIBIT 1

AND

CERTIFICATE OF SERVICE

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MAUI ELECTRIC COMPANY, LIMITED

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HAWAIIAN ELECTRIC COMPANY, INC. ("Hawaiian Electric"), HAWAI‘I ELECTRIC LIGHT COMPANY, INC. ("Hawai‘i Electric Light"), and MAUI ELECTRIC COMPANY, LIMITED ("Maui Electric") (collectively, the "Hawaiian Electric Companies" or the "Companies") respectfully move the Public Utilities Commission of the State of Hawai‘i (the "Commission") for clarification and/or partial reconsideration of Order No. 38482 *Approving with Modifications Hawaiian Electric's Grid Needs Assessment*, issued on June 30, 2022 in the subject proceeding ("Order 38482" or the "Order").

For reasons more fully set forth in the attached Memorandum in Support of Motion, the Companies respectfully request clarification and/or partial reconsideration of Order 38482 regarding the Commission's apparent shift to a new methodology (ELCC) that has not been adequately vetted for application in Hawai‘i and is not supported in the docket record. The Companies suggest that the Commission allow the first cycle of IGP to complete and then allow all parties involved to review and understand the successes and failures of the current grid needs assessment methodology (ERM/HDC). At that point, review of the methodology and evaluation

of alternative methodologies would be appropriate, but at this time a shift to a new methodology that has had minimal discussion throughout the proceeding is premature. The Companies have worked closely with the Technical Advisory Panel ("TAP") to revise and adjust the current methodology and, as shown in Exhibit 1 attached hereto, the TAP has similar concerns about whether a shift to a new methodology is appropriate given Hawaii's high renewable penetration and overall process efficiency considerations.

In addition, the Companies respectfully request an extension of the deadlines to file the finalized Grid Needs Assessment Methodology and ELCC Workplan from August 31, 2022 to September 14, 2022. As described further in the attached Memorandum in Support of Motion, good cause exists to grant an extension in light of competing obligations requiring overlapping resources.

This motion is filed pursuant to the Commission's Rules of Practice and Procedure, Hawai'i Administrative Rules ("HAR") Sections 16-601-23, -41 and -137,[1] the entire record in Docket No. 2018-0165, and the facts and law set forth in the Memorandum in Support of Motion, which is attached hereto. Because written filings alone may not be the most effective means to allow for full comprehension of the issues raised in this motion, the Companies request a hearing on this Motion, or, in lieu of a formal hearing, the Companies suggest holding a technical conference on the subject matter of Order 38482 to allow the Companies to be available for discussion and to answer any further questions the Commission may have. Alternatively, the stakeholders could schedule an IGP Stakeholder Technical Working Group

[1] HAR § 16-601-137 states that a motion seeking any change in an order of the Commission "shall be filed within ten days after the decision or order is served upon the party . . ." The Commission's Certificate of Service indicates that Order No. 38482 was served on June 30, 2022, the date it was uploaded to the Commission's Document Management System. Ten days from June 30, 2022 is July 10, 2022, and pursuant to HAR § 16-601-22, the next calendar day which is not a Saturday, Sunday, or holiday is July 11, 2022. Therefore, this Motion is timely filed.

meeting with the TAP to discuss the issues to better inform the Commission's decision making given the technical nature of the subject matter.

DATED: Honolulu, Hawai'i, July 11, 2022.

/s/ James E. Abraham
JAMES E. ABRAHAM

Attorney for
HAWAIIAN ELECTRIC COMPANY, INC.
HAWAI'I ELECTRIC LIGHT COMPANY, INC.
MAUI ELECTRIC COMPANY, LIMITED

BEFORE THE PUBLIC UTILITIES COMMISSION

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In the Matter of PUBLIC UTILITIES COMMISSION Instituting a Proceeding To Investigate Integrated Grid Planning.	DOCKET NO. 2018-0165

MEMORANDUM IN SUPPORT OF MOTION

I. INTRODUCTION

The Hawaiian Electric Companies appreciate the Commission's approval of the Grid Needs Assessment Methodology ("GNA"), with modifications, in Order 38482 and the guidance provided therein. However, the Companies feel strongly that the Commission's shift in Order 38482 from the current methodology relied upon by the Companies in the GNA[2] to an effective load carrying capability ("ELCC") resource adequacy approach is premature and unsupported in the docket record.

The methodology utilized in the GNA has been developed over the course of the past two-plus years of the IGP proceeding in coordination with, and based on feedback from, the TAP and stakeholders. By contrast, ELCC has only been minimally discussed and has not been heavily relied upon throughout this proceeding and the development of the GNA. Indeed, likely due in part to the limited discussion of ELCC, Order 38482 appears to have certain misconceptions about ELCC in comparison to the ERM/HDC methodology, as more fully

[2] The current methodology is an alternative energy reserve margin ("ERM") planning criteria, including an exceedance-based hourly dependable capacity ("HDC") metric, referred to herein as the "ERM/HDC" methodology.

discussed herein, and the Companies submit that the current methodology meets the Commission's goals of (1) transparency, (2) interactivity among resource types, and (3) avoiding bias toward firm resources. The Companies are willing to further explore, in coordination with the TAP, whether using ELCC in capacity adequacy analyses over long-term horizons is a superior alternative to the current methodology or other industry established reliability methodologies; however, this will take significant time and resources, has not been fully vetted, and therefore is premature. The Companies request partial reconsideration of Order 38482 to allow the first IGP cycle to complete, at which time review of the current methodology and potential alternatives would be more appropriate.[3]

As noted by the TAP (see Exhibit 1 attached hereto), "While ELCC is widely recommended today, resource adequacy experts in California and on the TAP are starting to move away from it for very high renewable scenarios, and the TAP does not see it as the obvious best choice." The Companies share the TAP's concerns because Hawai'i has a high renewable penetration that may not be present for mainland utilities that rely upon ELCC for their resource adequacy planning.

Moreover, the IGP process is designed to be iterative and build upon past experience and lessons learned. Significant time, effort, and resources have been spent by the Companies, the TAP, and stakeholders to develop ERM/HDC in this first round of IGP, which efforts should not be forfeited by starting from scratch with ELCC in the next round of IGP. The current ERM/HDC methodology is much less time intensive than ELCC and, ultimately, the ERM/HDC analysis and ELCC will generally reach the same result.

[3] Alternatively, if the Commission is not inclined to wait until the end of the first IGP cycle, the Companies request clarification and/or partial reconsideration that the workplan required by Order 38482 be focused on evaluating *whether ELCC is appropriate* rather than being the pre-determined outcome.

Due to the need for additional time and resources, and given competing needs (some of which rely upon the current GNA methodology), the Companies request that the Commission reconsider the immediate imposition of restrictions on the use of the current GNA methodology in other proceedings without prior Commission approval. If the Commission is steadfast on its preference to move toward an ELCC methodology, the Companies require clarification as to how this restriction can be imposed without undue burden and delay to procurements and programs that will rely upon IGP analysis.

The Companies appreciate input from all stakeholders involved in the IGP process, including the Commission, but have concerns that past efforts will be wasted and future efforts inefficient if a measured approach is not taken moving forward.

II. LEGAL STANDARD

Hawai‘i Administrative Rules Section 16-601-137 states, "[a] motion seeking any change in a decision, order, or requirement of the commission should clearly specify whether the prayer is for reconsideration, rehearing, further hearing, or modification, suspension, vacation, or a combination thereof. The motion shall be filed within ten days after the decision or order is served upon the party, setting forth specifically the grounds on which the movant considers the decision or order unreasonable, unlawful, or erroneous."

"[T]o succeed on a motion for reconsideration, the movant must demonstrate that the commission's decision or order was 'unreasonable, unlawful, or erroneous.'" *In re Hawaiian Elec. Co.*, Docket No. 05-0069, Decision & Order No. 22921, at 6, 2006 WL 3736077 (Oct. 4, 2006). In evaluating a motion for reconsideration, the Commission considers "whether matters have been overlooked or mistakenly conceived." *Id.* (citing *In re Gray Line Haw., Ltd.*, Docket

No. 96-0217, Decision & Order No. 15380 (Feb. 25, 1997) and *In re Kauai Elec. Div. of Citizens Utils. Co.*, 61 Haw. 166, 195 (1978)).

Clarification and modification is proper where "[i]t was not the commission's intent" to cause or bring about a result or consequence through the language of an existing order (*see In re Hawaiian Elec. Co., Inc.*, Docket No. 03-0036, Order No. 21463 (Nov. 17, 2004)), or where it is necessary to correct "implications" or to ensure "consistency" with existing law (*see In re Hawaiian Elec. Co., Inc.*, Docket No. 05-0276, Order No. 22858 (Sept. 15, 2006)), or where a particular finding or statement constitutes an "inadvertent error" (*see In re Laie Water Co., Inc.*, Docket No. 00-0017, Order No. 18479 (Apr. 11, 2001)), or where "there may be some confusion regarding" the applicability of an order (*see In re Waikoloa Water Co., Inc., Waikoloa Sanitary Sewer Co., Inc., Waikoloa Resort Utilities, Inc., & Hawaii Water Serv. Co., Inc.*, Docket No. 2008-0018 (Mar. 12, 2009)).

A motion for clarification should be granted, and the language of an order appropriately modified, where it is reasonable to do so. *In re Hawaiian Elec. Co., Inc.*, Docket No. 05-0276, Order No. 22858 (Sept. 15, 2006) ("Accordingly, the commission finds it reasonable to grant [Hawaiian Electric's] Motion for Clarification and amend ordering paragraph no. 1[.]"); *In re Polynesian Adventure Tours, LLC, Roberts Tours & Transp., Inc., & Carry-All, Inc.*, Docket No. 2016-0160, Order No. 34101 (Nov. 9, 2016) ("the commission finds the requests for clarification, reconsideration, and/or modification . . . to be reasonable, and therefore orders the following . . .").

III. THE COMMISSION SHOULD RECONSIDER ORDER 38482 TO THE EXTENT IT IS DIRECTING AN IMMEDIATE SHIFT TO ELCC METHODOLOGY WITHOUT ADEQUATE SUPPORT IN THE RECORD

A. ELCC Does Not have Support in the Docket Record and Selection of the ELCC as the Path Forward for IGP is Premature.

The Companies respectfully request that the Commission reconsider its apparent shift to ELCC at this time because it has not been vetted in this proceeding as a preferable alternative to the current ERM/HDC method used in the GNA and supported by the TAP.

The Companies derived the current ERM/HDC methodology over the course of the past two years in coordination with the TAP and stakeholders. For example, at the November 1 and 18, 2021 Resource Adequacy and Modeling Sub-Committee meeting, Telos Energy presented their evaluation of ERM and HDC. Telos Energy found that (1) 30% ERM provided for a reasonable level of reliability for the current resource mix,[4] (2) resource adequacy back check (*i.e.*, probabilistic modeling in PLEXOS) is needed,[5] which the Companies have committed to, and (3) HDC calculations should be considered further. Telos Energy went on to specify five recommendations for HDC[6] that the Companies have since reviewed and/or implemented.[7] However, in Order 38482, the Commission appears to disregard the extensive efforts that have been undertaken to develop the current methodology, including the incremental improvements

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[4] *See* HNEI Grid Integration – ERM Calibration and Resource Adequacy (Nov. 1, 2021), *available at* https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/technical_advisory_panel/20211101_tap_hnei_grid_integration_erm_calibration.pdf, at 9.

[5] *Id.* at 10.

[6] *Id.*

[7] In response to the Telos Energy recommendations, the Companies presented its adjusted HDCs at a January 20, 2022 TAP meeting (available at https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/technical_advisory_panel/20220120_tap_meeting_presentation_materials.pdf) wherein the Companies used a monthly grouping of similar hours of wind and solar, instead of a 3-day rolling average; increased the data sample set to calculate the HDCs using NREL data instead of recent historical output; reviewed California's exceedance methodology (*see also* the Companies' response to PUC-HECO-IR-36) and compared to the HDC method, leading to the Companies' adoption of an 80th percentile HDC for both wind and solar production instead of 1- or 2-sigma.

the Companies have employed in coordination with the TAP and stakeholders throughout the past 2+ years of the IGP process focused on discussing reliability guidelines and criteria.

In contrast to the extensive examination of the current methodology, there has been minimal discussion or vetting of ELCC applied to Hawai‘i as part of IGP in the docket record. The few mentions of ELCC by the Companies have been to explain why ELCC was not utilized. First, as mentioned in response to PUC-HECO-IR-36, while the Companies did evaluate ELCC as an alternative, it was found inferior to the current ERM/HDC methodology:

> ELCC represents the incremental capacity value of a particular resource type, assuming all other assumptions are held constant including modeled system load and resource mix. However, when developing resource plans over a long-term horizon, the load and resource mix can vary significantly across years and planning scenarios, which would lead to changing ELCC values over time and is difficult to properly implement in the modeling. For these reasons, the Companies developed their HDC concept for variable resource capacity. Some of the challenges of using ELCC are described by the Electric Power Research Institute's January 2021 technical update to "Exploring the Impacts of Extreme Events, Natural Gas Fuel and Other Contingencies on Resource Adequacy".[8]

In addition, the Companies' reasoning for preferring the ERM/HDC method over ELCC was also discussed in the November 2021 GNA Review Point:

> When considering the capacity accreditation of variable renewables toward the ERM criteria (to meet system demand), the HDC framework was preferred over other approaches like Effective Load-Carrying Capability (ELCC). HDC does not depend on assumed load profiles, maintenance schedules, and resource mix of the system and can be calculated independent of the other generators in the portfolio. The intent of HDC is to plan for a different variable resource capability in every hour and could be described as an hourly ELCC. Its derivation allows for a granular analysis of weather variability and reliability of generation from variable renewable resources in each hour. As recorded variable renewable data

[8] *See* https://www.epri.com/research/products/000000003002019300, at pages 3-1 through 3-7, which in pertinent part states: "[T]here are many challenges with using ELCC for resource planning and in capacity markets. While ELCC can likely be improved and is an important metric for thinking about resources over the short term, as more variable energy resources (VERs) and storage become part of the mix, conventional ELCC calculations become increasingly problematic."

> changes, new data can be easily incorporated to update the HDC values and would not require a system level analysis like the ELCC.[9]

Although the Commission has expressed concerns regarding the HDC approach in the past, at no time has the Commission provided guidance on their preference to move toward ELCC over the past 2+ years. Rather, in expressing its concerns, the Commission "encourage[d] Hawaiian Electric to continue working with the TAP to develop better alternatives."[10] The Companies have done just that, expending significant time and effort to obtain the TAP's acceptance of the Company's adjustments to the ERM/HDC methodology.

Whereas ERM/HDC has undergone extensive scrutiny with analysis and calibration, there has been no extensive discussion or analysis with the Commission, stakeholder council, the TAP, or in working groups of substituting the refined ERM/HDC methodology with ELCC. To now direct a shift to ELCC when ERM/HDC has been thoroughly examined, and adjusted in consideration of stakeholders' input, will only repeat efforts and cause further delay. As a whole, ELCC was minimally discussed by the stakeholders throughout the IGP process, and at no point did the Commission indicate that the Companies should dedicate more resources to examining ELCC as an alternative. Earlier guidance would have allowed the Companies to fully vet these matters, as well as conduct comparative analyses over the past two-plus years.[11]

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[9] *The Hawaiian Electric Companies' Grid Needs Assessment Methodology Review Point*, filed on November 5, 2021 in the subject proceeding ("November 2021 GNA Review Point"), at 103.

[10] Order No. 38253 *Approving, with Modifications, Hawaiian Electric's Revised Inputs and Assumptions*, issued on March 3, 2022 in the subject proceeding, at 30.

[11] In Order 38482, the Commission simply states: "Like Ulupono, the Commission believes that ELCC could meet these needs." (Order 38482 at 28.) While Ulupono did briefly suggest ELCC as an alternative in their December 17, 2021 Comments (Attachment 1 at 8, 10), Ulupono had not raised this method previously. Thus, there is minimal support on the record for ELCC, even from Ulupono.

In addition, it appears that the Commission has also adopted Ulupono's idea that all aspects of a complex energy system need to be planned within one software tool, RESOLVE. However, it is well established that, particularly in a high renewable environment like Hawai'i, a single tool cannot be relied upon. The TAP stated early on that RESOLVE is useful for providing directional resource portfolios that then need to be vetted through different types of analyses, which led the Companies to adopt a modeling framework consistent with their recommendations. The TAP stated, "it was again noted that RESOLVE provides limited fidelity and should be used only as a

In addition, the O‘ahu GNA analysis[12] demonstrates that the current process (ERM/HDC along with probabilistic analyses in the RA step) appropriately balances time/efficiency, optimization of resource plans, and reliability. In other words, the significant additional time to conduct a ELCC/PRM[13] study and the associated iterations do not outweigh their benefits. The O‘ahu GNA shows that the RESOLVE plan can still be optimized while evaluating the resource adequacy through extensive probabilistic analyses. Adding the ELCC step up front is likely to increase the time to complete an IGP cycle by 6-12 months with little added value given the commitment to conduct probabilistic reliability analyses in the resource adequacy step of the IGP process, which is undoubtedly a more accurate assessment of system reliability.

Accordingly, because the docket record does not support an immediate shift from the current vetted methodology to ELCC, which has only been minimally discussed in this proceeding, the Companies respectfully request that the Commission reconsider Order 38482 to the extent it instructs Hawaiian Electric to develop a workplan "to begin the process of developing an ELCC-based resource adequacy criteria for use in future rounds of IGP, and perhaps elsewhere."[14] While the Companies are open to further exploring improvements and even alternative methodologies to be utilized after the first round of IGP has completed, a wholesale shift to the ELCC methodology should not be selected as the path forward without support. Moreover, the timing of any such exploration of alternatives should not take place now,

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technology screening tool. Subsequent determination of reliability, analysis of multi-year weather data, retirements, and avoided costs, etc. requires the use of other modeling tools. It was emphasized more than once that the other models should be an integral part of the overall process, NOT just a check on the output from RESOLVE." (*See Letter From: M. Asano To: Commission Re: Docket No. 2018-0165 - Integrated Grid Planning; Instituting a Proceeding to Investigate Integrated Grid Planning; Grid Services and Planning Criteria Feedback*, filed on June 1, 2021, at 4.)

[12] The Companies submitted a draft Near-term GNA for O‘ahu on June 17, 2022, to the IGP Stakeholder Technical Working Group members.

[13] Planning Reserve Margin or "PRM" is an intertwined component of the ELCC framework. PRM is similar to the ERM used in the current GNA methodology.

[14] Order 38482 at 28 (footnote omitted).

but should wait until the first round of IGP has completed and the Companies, the TAP, and stakeholders have additional data on the successes and failures of the current methodology (as well as the potential benefits that ELCC may have over the current methodology). Thus, the Companies request that, instead developing an ELCC-focused workplan at this time, further action be delayed until conclusion of the first IGP cycle.[15]

B. The Current ERM/HDC Methodology Meets the Commission's Stated Goals.

The need for further support in the docket record before potentially shifting to ELCC is exemplified by the misconceptions found in Order 38482 with respect to the purported benefits of ELCC over the ERM/HDC methodology.

In Order 38482, the Commission set forth its main bases for supporting an ELCC methodology over the current ERM/HDC metric:

> Notwithstanding the above, the Commission, like the TAP, believes it is appropriate to explore improvements to Hawaiian Electric's resource adequacy modeling. Specifically, the Commission would like to see methodologies that: (1) can be transparently derived from other models, such as PLEXOS, to minimize or even eliminate opaque planning judgments; (2) incorporate the interactive effects between resource types in determining their contributions to system reliability; and (3) use realistic assumptions about variable generators' availability, so as to not unfairly bias resource selection in RESOLVE towards firm thermal capacity. These characteristics will become more important as the State adds more variable renewable energy resources and storage. Like Ulupono, the Commission believes that ELCC could meet these needs.[16]

As an initial matter, the TAP is <u>not</u> in agreement that ELCC is the appropriate path forward for IGP, noting that, "ELCC is current best practice in most regions, but California and Hawaii are moving away from it, so alternatives should be evaluated[.]"[17] The Commission is

[15] Alternatively, if the Commission is not inclined to wait until the end of the first IGP cycle, the Companies request clarification and/or partial reconsideration that the workplan required by Order 38482 be focused on evaluating *whether ELCC is appropriate* rather than being the pre-determined outcome.
[16] Order 38482 at 27-28 (footnote omitted).
[17] *See* Exhibit 1 at 7.

correct that the TAP believes it is appropriate to explore improvements to the Companies' resource adequacy modeling, as shown on a slide from the TAP's May 4-5, 2022 presentation.[18] Specifically, Slide 28 cited by the Commission suggests several areas for improvement in the current ERM/HDC methodology.[19] Notably, the subsequent slide (Slide 29) explains that the Companies have included all of the TAP's recommended improvements.[20] It should be emphasized that at no time during the IGP process did the TAP suggest that the improvements to the current GNA methodology should involve a wholesale switch from the ERM/HDC metric to ELCC. Rather, the TAP has been focused on improving the ERM/HDC methodology.

At a recent meeting with the TAP on July 7, 2022 to discuss Order 38482, the TAP recommended that alternatives to ELCC should be evaluated. Specifically, the TAP found:

> **Regarding the order to use ELCC**: While ELCC is widely recommended today, resource adequacy experts in California and on the TAP are starting to move away from it for very high renewable scenarios, and the TAP does not see it as the obvious best choice. The TAP believes that further evaluation of capacity accreditation options is warranted before committing to use ELCC.
>
> ELCC calculations are very time-consuming and nuanced. Decisions on average versus marginal ELCC and how to best represent both saturation effects and portfolio effects need to be considered. Heuristic approaches may give a similar, representative answer in much less time. In addition, the TAP recommends testing various bookend capacity credits in RESOLVE to understand how sensitive the model results are to this assumption.
>
> The TAP suggests that rather than committing to ELCC, ELCC should be compared to other approaches (mentioned below) by running selected simulations and comparing costs, resource mixes, and time to produce result. Based on that comparison, the approach that produces the least-cost adequate mix should be used (subject to a system-level minimum reliability standard / maximum risk metric such as LOLE, NEUE, etc). If

[18] It appears that the citations included in footnotes 82 and 83 in Order 38482 were inadvertently reversed.
[19] *See* May 4-5, 2022 IGP Technical Advisory Panel Presentation Slides, available at https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/technical_advisory_panel/20220505_tap_presentation_materials.pdf, at 28.
[20] *Id.* at 29.

> two or more approaches result in resource costs that differ by an amount smaller than the uncertainties in those cost estimates, the more time-efficient approach can be selected.

The TAP meeting notes from this July 7, 2022 call are being provided as Exhibit 1 to this Memorandum in Support of Motion.

Further, the current ERM/HDC methodology appears to meet the Commission's three stated goals in Order 38482. First, the current methodology is transparent and ELCC is not inherently more transparent than ERM/HDC. ELCC will need to be calculated by a model. Every assumption used in that model to calculate ELCC will require expert judgement to assess whether it is reasonable and appropriate. These assumptions will extend beyond the data that was provided in the approved inputs workbooks for IGP, as there will be several more assumptions that will need to be vetted specifically for the ELCC determination. Thus, because there are substantially more assumptions that rely on expert judgement to develop ELCC than there is for ERM/HDC, it is not clear that ELCC is more transparent than ERM/HDC.

In contrast to ELCC, ERM/HDC can be calculated transparently in spreadsheets using data sources that can easily be tracked and cells that can be traced to aid understanding of the calculation. ELCC calculations rely on a modeling tool and numerous planning assumptions and runs according to the computational logic embedded by the software. The flexibility of ELCC is further hampered by its dependency on the other resources assumed to be on the system and assumptions for system load, all of which are highly uncertain in the current dynamic environment. Because of this dependency, ELCC would need to be re-calibrated prior to and following any RFP and upon projects withdrawing from the process, as well as when new resources are added incrementally over the horizon of a long-term resource plan.

The Companies agree with the Commission's emphasis on transparency and have concerns regarding the conclusions reached in the Order that may improperly influence the Commission's preference for ELCC. For example, Order 38482 states that:

> Unlike the proposed HDC metric, which derates solar and wind capacity by an arbitrary 1- or 2-sigma deduction, ELCC assigns capacity credits to variable energy resources based on their actual contribution to resource adequacy revealed by stochastic reliability analysis.[21]

It should be made clear that 1-sigma and 2-sigma reductions are not arbitrary. These sigma reductions result in probabilities that are comparable to firm unit unplanned outages. The magnitude is informed by actual historical variability in that hour and season over several years. The Companies have performed probabilistic reliability analysis and believe the analysis should not value solar and wind at full historical output values of only one year. Having difficulty determining a precise sigma is not a reason to (1) abandon the concept, or (2) not reduce the resource at all. The proposed 80th percentile wind HDC is based on actual wind data and the 80th percentile solar HDC is based on NREL's National Solar Radiation Database, statistically analyzed to capture a range of weather days, leaving out 20% of weather data that could have worse production than what is being modeled in the HDC.

Second, the current ERM/HDC methodology does, in fact, incorporate the interactive effects between resource types in determining their contributions to system reliability. Order 38482 asserts that:

> Unlike HDC, ELCC captures both the synergistic and antagonistic interactions between resources in a portfolio.[22]

However, similar to ELCC, HDC will capture synergistic and antagonistic interactions between resources in a portfolio when used as part of the ERM criteria, and was used to

[21] Order 38482 at 24.
[22] *Id.* (footnote omitted).

demonstrate that adding solar and storage resources together could provide greater reliability benefits than either resource individually. In the November 2021 GNA Review Point,[23] the Companies observed the interactive effects of combining solar and storage to meet capacity needs, as shown in Figure 1 below.

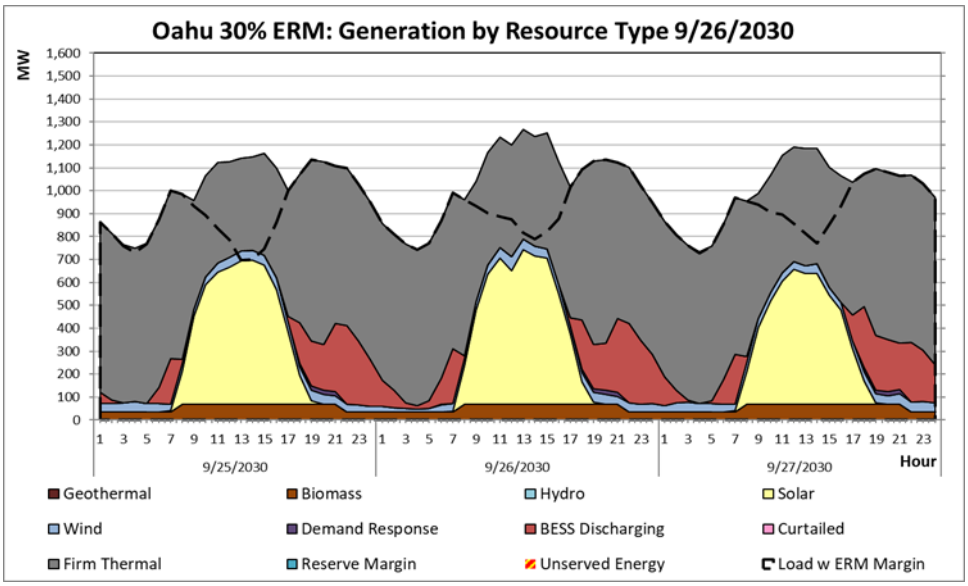

Figure 1: O'ahu System Dispatch for Production Simulation

This effect is similar to the following figure cited in footnote 80 of Order 38482:

Figure 2-7. The "diversity benefit" of solar and storage in their impact on resource adequacy

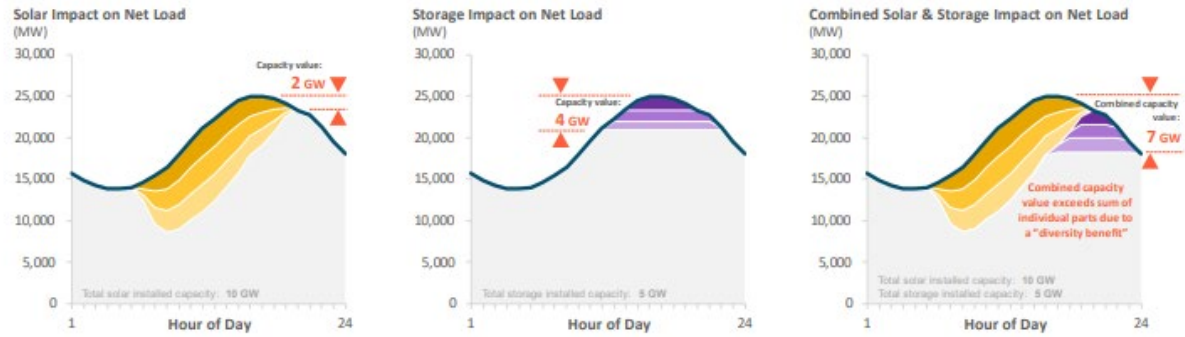

Figure 2: Illustrative Example of Interactive Effects of Solar and Storage for Capacity

[23] November 2021 GNA Review Point at Exhibit 1, page 134.

Moreover, because of the extremely high penetrations of private rooftop solar in Hawai‘i, the system peak consistently occurs in the evening, which is unlike other utilities on the mainland where ELCC may be an effective method to credit resources for their contribution to capacity. With an abundance of solar generation during the daytime, the solar market in Hawai‘i has moved toward projects that are exclusively solar paired with storage. In other words, the synergistic effects are inherent for the Hawai‘i grid. The value of an ELCC methodology becomes even less effective in the future as demonstrated in the O‘ahu GNA, as shown in Figure 3 below from the draft O‘ahu GNA. The combined effect of extremely high penetration of solar and storage shown in gold (New Paired) as well as standalone PV shown as DGPV and existing PV (orange) all combine to provide capacity contributions during the evening peak along with other hours of the day. With this high penetration of solar, wind, and battery energy storage, the load that is served by firm generation is essentially flat throughout the entire day (*i.e.,* there is no defined “peak” hour).

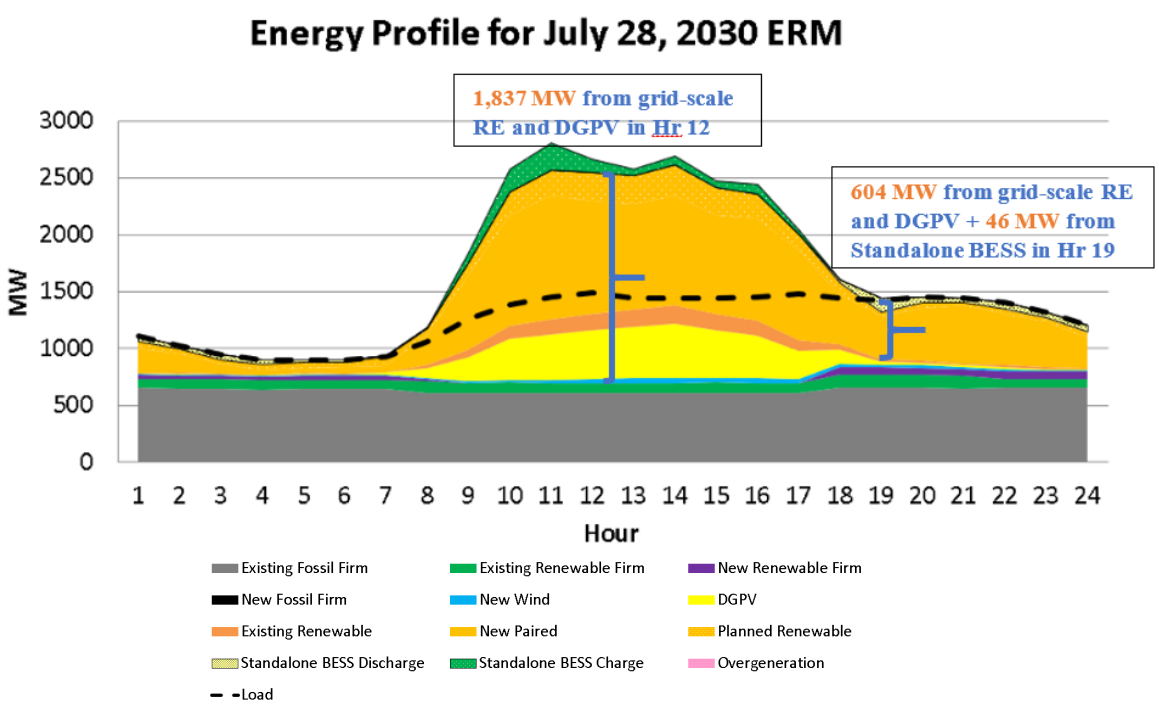

Figure 3: Dispatch for O‘ahu 2030 ERM Test

Thus, the current methodology meets the Commission goal of incorporating the interactive effects between resource types in determining their contributions to system reliability.

Third, the current methodology does not unfairly bias resource selection in RESOLVE toward firm thermal capacity. Indeed, the O‘ahu GNA proves that the ERM/HDC methodology does not bias towards firm generation. In the O‘ahu GNA, RESOLVE continued to select large amounts of solar paired with battery energy storage and wind resources, with minimal selection of new firm generation, as shown in Figure5, which is a graphical representation of Figure 4, below. In other words, the use of ERM and HDC did not limit the build of low cost renewables (*see*, capacity builds in the “New Paired” row, Figure 4), even with the added renewable energy zone costs that were attached to the solar and wind resources in the RESOLVE optimization.[24]

Capacity (MW)	Base			Low Load			High Load		
	2030	2040	2050	2030	2040	2050	2030	2040	2050
Existing Renewable Firm	77	77	436	77	77	436	77	77	436
New Renewable Firm	35	251	690	0	177	541	250	596	877
Existing Fossil Firm	921	580	0	921	580	0	921	580	0
Planned Renewable	585	585	585	585	585	585	585	585	585
DGPV	803	936	1008	1042	1273	1370	776	911	983
New Paired	1577	2623	3187	1290	1953	2865	1677	2943	3187
Existing Renewable	336	174	45	336	174	45	336	174	45
New Wind	163	241	241	163	208	208	163	368	368

Figure 4: Resource plans optimized by RESOLVE using ERM and HDC for various scenarios (Figure 6-6 from the O‘ahu GNA)

[24] Draft O‘ahu GNA at 33-36.

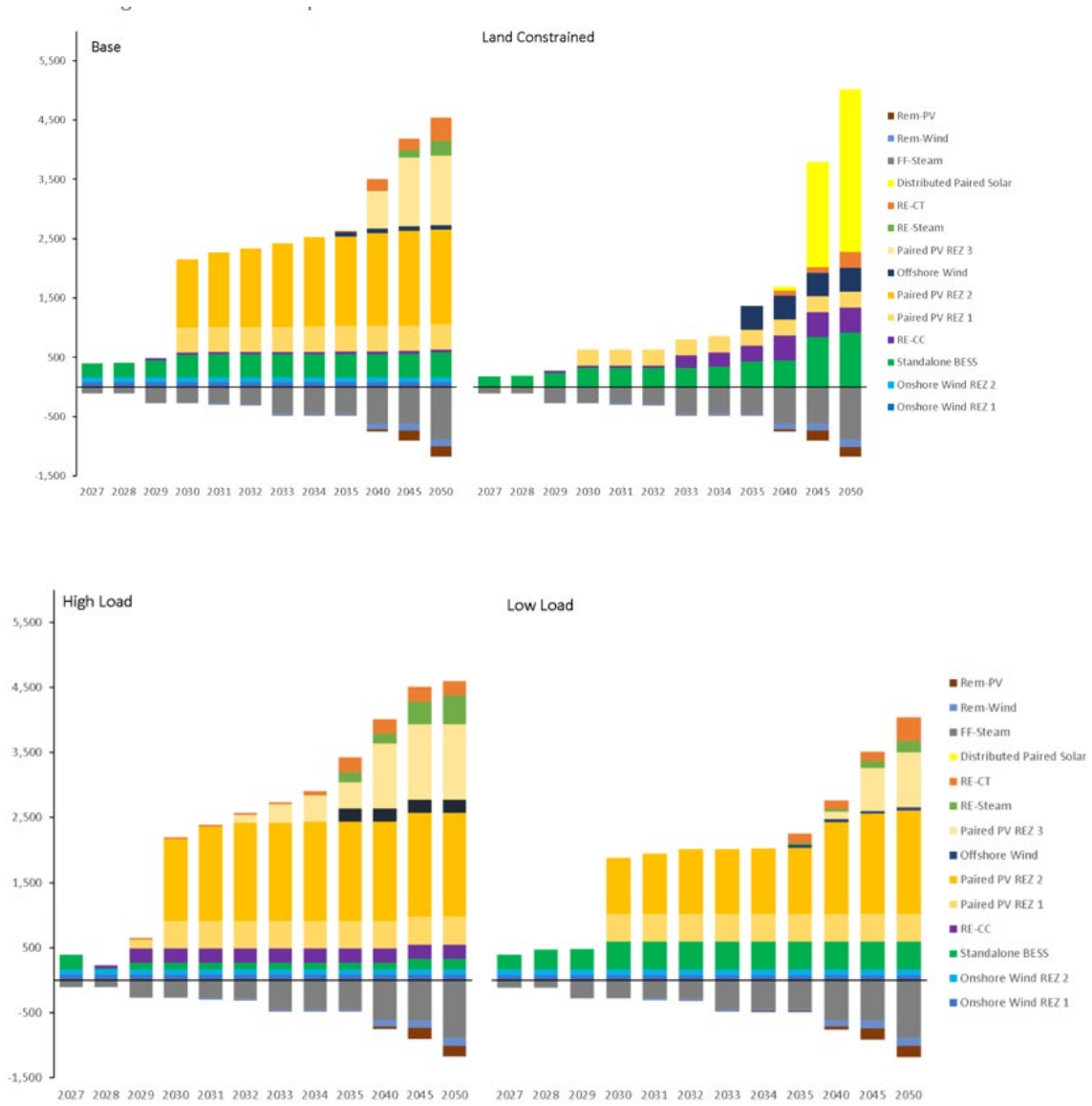

Figure 5: Resource plans optimized by RESOLVE for various scenarios (Figures 6-2 and 6-4 from the O'ahu GNA)

Accordingly, the vetted ERM/HDC methodology supported by the TAP addresses the Commission's methodology goals of (1) transparency, (2) interactivity among resource types, and (3) avoiding bias toward firm resources, and the Companies submit that a shift away from the current methodology to ELCC would result in minimal benefit to these areas while requiring significant effort and resources.

C. ELCC Disfavors Renewable Resources in High Penetration Environments and, Therefore, is not Appropriate for Hawai‘i.

In order to achieve 100% Renewable Portfolio Standard by 2045, it is imperative that the Companies maximize contributions from renewable resources. One drawback from utilizing ELCC is that it is not suitable for a high renewable penetration environment such as Hawai‘i, as discussed above. An Electric Power Research Institute report also highlights potential challenges with ELCC:

> ELCC works reasonably well when the number of VERs and storage is small compared to the overall size of the system. For conventional dispatchable resources, ELCC is well defined given system demand and target LOLE. That is, the ELCC of a conventional dispatchable generation unit has a unique value that is independent of the other resources.
>
> ELCC is usually calculated for incremental additions, taking the rest of the system as fixed. Sometimes the average ELCC for a set of resources is calculated. However, ELCC calculations do not consider common mode events such as unexpected changes in wind or solar output across a large a set of resources.
>
> For VERs and storage, ELCC is not unique. As more VER units are added, the ELCC of each incremental unit added tends to decline. It is easy to see why this is so for solar: as more and more units are added, the net peak load (system peak load less output of variable resources) moves later in the day to when there is less sun light. The net effect is a declining ELCC for each incremental unit as more solar plants are added. The same effect is observed for wind and storage.[25]

To that end, the TAP stated that probabilistic analysis in the resource adequacy step of the IGP process will be critical, and that the ERM/HDC concept, including some additional improvements, may be a more efficient and appropriate methodology and framework:

> Probabilistic RA gives enough confidence in adequacy. ERM approach is a step forward relative to ELCC if HDC can be replaced with an [*sic*] more equitable approach. ELCC will take a lot longer, probably need to find a faster tool than PLEXOS, or use heuristic.

[25] Electric Power Research Institute's January 2021 technical update to "Exploring the Impacts of Extreme Events, Natural Gas Fuel and Other Contingencies on Resource Adequacy" (Jan. 28, 2021), *available at* https://www.epri.com/research/products/000000003002019300, at pages 3-3 through 3-4 (footnotes omitted).

> . . .
>
> Anecdotally, in RPM (NREL [capacity expansion] tool) we've seen storage capacity credit approximations stop working well at higher levels of renewables (forcing us to compensate by cranking up the PRM to get adequate systems), which is one reason I'm such a proponent of using ERM instead. I don't think we've published anything about that though.[26]

Ultimately, the TAP felt that continuing to compare alternative resource capacity accreditation methods would be the best course. ELCC/PRM could be one option; however, the general sentiment was that improving ERM/HDC methodology would be superior to the ELCC/PRM framework.

IV. IF THE COMMISSION IS INCLINED TO SHIFT TO ELCC AS PROPOSED IN ORDER 38482, THE COMPANIES REQUEST SPECIFIC CLARIFICATIONS ON CERTAIN ASPECTS OF THE ORDER

A. Clarification Regarding the Companies' Use of ERM/HDC Methodology Outside of IGP.

In approving Hawaiian Electric's alternative ERM planning criteria, including an exceedance-based HDC, the Commission noted that such approval was for this round of IGP only. Order 38482 states:

> ***If Hawaiian Electric wishes to employ this methodology outside of IGP, it must seek Commission approval to do so.*** The Commission acknowledges that the Near-Term grid needs assessment methodologies utilized for the Stage 3 RFPs for Hawai'i Island employ the exceedance-based HDC approach and shall not require the Companies to seek approval for this use case.[27]

The Companies require clarification as to how such Commission approval could be obtained and the timing surrounding such approval.

Significantly, the Companies must utilize the GNA methodology *prior to filing an application with the Commission*. Indeed, the Companies will need to use the GNA

[26] Exhibit 1 at pages 4-5.
[27] Order 38482 at 26-27 (emphasis added, footnote omitted).

methodology in determining the justification for whether a project is beneficial to the system. It would not be logical for the Companies to request approval at such an early stage, and it is unclear at what point such approval should be requested. Moreover, if the Companies were to internally rely upon its GNA methodology to identify a particular project, it is not clear whether the Companies could continue to rely upon such methodology in the Commission docket seeking approval, making the burden of proof much more difficult to meet at the outset.

While Order 38482 acknowledged that ERM/HDC is being utilized for the Stage 3 RFPs for Hawai‘i Island and that this "shall not require the Companies to seek approval[,]"[28] it should also be noted that in Docket No. 2017-0352 the Commission has directed the Companies to file GNAs for O‘ahu and Maui by July 29, 2022. These GNAs are substantially completed or underway and similarly employ the ERM/HDC methodology. Accordingly, the Companies request clarification as to whether the GNAs for O‘ahu and Maui can utilize the current methodology.[29] If not, the Companies request an extension to restart work on these deliverables, which would likely require at minimum 6-12 months[30] after the ELCC workplan required by the Order is completed.

B. ELCC Cannot be Implemented in Isolation; Additional Guidance is Needed.

Should the Commission deny the Companies' request to reconsider immediate ELCC implementation, additional guidance is needed. ELCC cannot be implemented in isolation; there are two additional components to an ELCC framework – PRM and a reliability criteria. ELCCs cannot be developed without first establishing a reliability criteria, such as loss of load

[28] Order 38482 at 27.
[29] Alternatively, the Companies request explicit Commission approval to do so pursuant to Order 38482.
[30] The Companies are uncertain at this time as to the exact timeframe required to implement ELCC for O‘ahu and Maui Islands, as the Companies currently do not have a model software selected to conduct these analyses and the time-consuming process to set up the model database with the necessary inputs and data will take time to complete.

expectation ("LOLE") of 0.1 days/year. Because ELCC is highly dependent on a specific resource mix including the appropriate reserve margin, the analysis to determine ELCCs use a defined PRM targeted to a specific reliability standard. Multiple iterations are completed to determine the capacity contribution of a resource type to satisfy the reliability criteria. In summary, because of the computationally intensive process of developing ELCCs, the Companies request that the Commission approve or provide guidance on appropriate PRM percentages and reliability target before commencing the process. Other considerations include:

(1) The Companies will need to first develop a draft workplan, then convene TAP, STWG and Stakeholder Council meetings to solicit stakeholder feedback.

(2) The process will take at least several months, and will last beyond August 31, 2022.

(3) ERM and HDC are used in many other dockets. Any effort that relies on a long-term resource plan uses ERM, such as but not limited to: all Power Purchase Agreement applications, all RFP evaluations, Adequacy of Supply, and any effort that incorporates reliability analysis such as Docket No. 2021-0024.

(4) Transitioning from ERM and HDC to ELCC needs to be clarified. ELCC can be substituted for HDC in RESOLVE resource expansion modeling; however, ELCC does not replace ERM.

(5) ELCC is not used in stochastic reliability modeling. ELCC is a comparison to perfect resources in a predetermined resource plan in a predetermined year. The Companies, along with stakeholders and guidance from the Commission, would need to first determine which plan to use and for which year. The quantity of each resource type will influence the ELCC and would need to be evaluated likely at different resource quantities

to test if ELCC values are substantially different. This work will likely take several months.

The Companies reiterate their request for a technical conference or IGP working group meeting to discuss the impacts Order 38482 will have on IGP and other proceedings moving forward.

C. Clarification Regarding the Sample Size of the Stochastic Assessment

The Companies request specific clarification regarding the apparent 1,250 sample size for the stochastic assessment of resource adequacy, which far exceeds the 250 sample size set forth in the GNA methodology as agreed to by the TAP.

Order 38482 states:

> The Commission therefore directs Hawaiian Electric to include the following elements in its stochastic assessment of resource adequacy: at least 250 stochastic outage draws, at least five historic or simulated weather years, and modeling that considers the chronological nature of dispatch decisions – to capture storage state of charge, thermal ramping constraints, minimum up and down times, and repair times, for example.[31]

Previously, the Companies proposed, and the TAP accepted, an approach to model 250 samples. At the March 10, 2022 TAP meeting,[32] the TAP noted that 250 samples is a reasonable start, which is equivalent to 50 randomized generator outages multiplied by five (5) weather years.[33] The above direction from Order 38482 appears incongruent with the proposed 250 total by requiring the 250 stochastic outage draws *each be run* for five (5) weather years. It is unclear to the Companies whether the Commission intended to follow the 250 total as proposed (50 * 5) or if it intended to increase the number of draws to 1,250 (250 * 5).

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[31] Order 38482 at 21.
[32] *See* the Companies' response to PUC-HECO-IR-37, filed on March 24, 2022 in the subject proceeding.
[33] *See* March 10, 2022 TAP Resource Adequacy and Modeling Sub-Committee, TAP Feedback (PDF), *available at* https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/technical_advisory_panel/20220310_tap_feedback.pdf, at 2.

Specifically, the Companies make this request for clarification because such an increase would substantially enlarge the amount of time and work required with negligible benefit. An increase to the number of random outage draws and resulting total sample count will show diminishing contributions to the reliability while significantly increasing computational load. While there are differences between models for different islands, 250 samples has a model run time of approximately 6-8 hours for O‘ahu, which includes preserving the operating characteristics that the Commission specified in its directive, to capture thermal ramping constraints, minimum up and down times, and repair times. In the April 28, 2022 TAP meeting materials, on Slides 11-14, the various reliability metrics demonstrated convergence prior to 250 total simulations.[34]

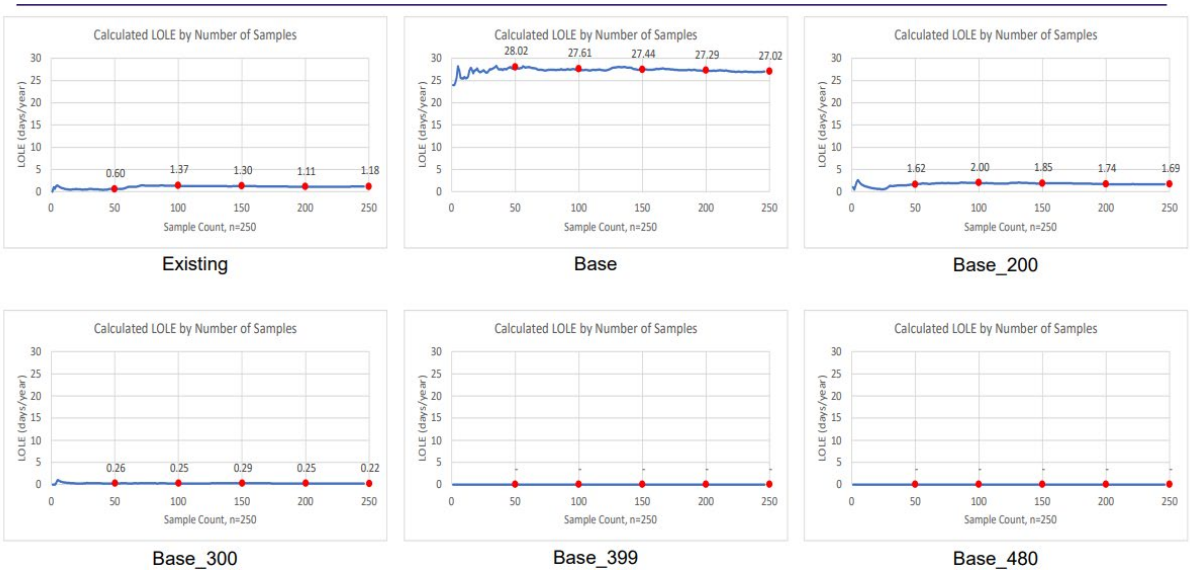

Figure 6: Convergence of the Probabilistic Metrics

As shown in Figure 6, above, across a variety of cases, the LOLE is relatively stable as the cumulative sample count increases to 250, indicating that running additional samples above 250

[34] *See* April 28, 2022 TAP Resource Adequacy and Modeling Sub-Committee, Presentation Slides (PDF), available at https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/technical_advisory_panel/20220428_tap_presentation_materials.pdf, at 11-14.

may not be significantly different. It should also be noted that the sample size number can be reevaluated after the first IGP cycle is completed.

In light of the foregoing, the Companies respectfully request clarification as to the Commission's intent relating to its direction on the sample size for the stochastic assessment.

V. REQUEST FOR EXTENSION OF TIME

The Companies respectfully request an extension of the deadlines to file the finalized Grid Needs Assessment Methodology and ELCC Workplan from August 31, 2022[35] to September 14, 2022. Good cause exists for an extension in light of (1) potential delay due to the pendency of this Motion and remaining items requiring clarification discussed herein, and (2) Order No. 38479 *Approving the Hawaiian Electric Companies' Final Stage 3 Request for Proposals for Hawaii Island with Modifications and Issuing Guidance on the Proposed Stage 3 Requests for Proposals for Oahu and Maui*, issued on June 30, 2022 in Docket No. 2017-0352, which requires the Companies to file O'ahu and Maui grid needs assessments by July 30, 2022. Significant overlap exists with respect to the internal resources needed to perform both of these tasks and the Companies will not be able to focus on the IGP deadlines until after the filing in Docket No. 2017-0352. To the extent the Commission holds a technical conference or otherwise makes findings in ruling on this Motion that may affect these deliverables, the Companies respectfully request an extension for a reasonable amount of additional time as needed to incorporate such findings. Accordingly, good cause exists to grant the Companies an extension under the circumstances.[36]

[35] *See* Order 38482 at 63, Ordering Paragraph Nos. 1 and 2.
[36] This request is made pursuant to HAR § 16-601-23.

VI. CONCLUSION

Based on the foregoing, the Companies respectfully request (1) clarification and/or partial reconsideration on the points raised and discussed herein, and (2) an extension of time to comply with Ordering Paragraph Nos. 1 and 2.

DATED: Honolulu, Hawai‘i, July 11, 2022.

/s/ James E. Abraham
JAMES E. ABRAHAM

Attorney for
HAWAIIAN ELECTRIC COMPANY, INC.
HAWAI‘I ELECTRIC LIGHT COMPANY, INC.
MAUI ELECTRIC COMPANY, LIMITED

HECO IGP Technical Advisory Panel
Summary and Feedback from July 2022 Meeting Related to PUC Order on Grid Needs Assessment
7/8/2022

This feedback and summary was delivered by the IGP Technical Advisory Panel (TAP) to Hawaiian Electric (HECO) based on HECO's slides and presentation at the full TAP meeting on July 7, 2022. It relates to the PUC order released the prior week on the Grid Needs Assessment.

TAP members present:

- Andy Hoke (NREL, Chair)
- Aidan Tuohy (EPRI, Vice-Chair)
- Matthias Fripp (UH)
- Elaine Hale (NREL)
- Debbie Lew (ESIG)
- Jo Ann Ranola (EPRI)
- Matt Richwine (Telos)
- Derek Stenclik (Telos)
- Gord Stephen (NREL/UW)

HECO participants:

- Marc Asano
- Ken Aramaki
- Collin Au
- Lisa Dangelmaier
- Riley Fukuji
- Chris Kinoshita
- Janelle Kau
- Brian Lam
- Chris Lau
- Isaac Lum
- Chris Ono
- Dean Oshiro
- Li Yu

TAP feedback and comments are divided into three categories:

1. Informational
2. Action recommended prior to August GNA deadline
3. Action recommended after August GNA deadline

Summary of TAP Feedback

Regarding the order to use ELCC: While ELCC is widely recommended today, resource adequacy experts in California and on the TAP are starting to move away from it for very high renewable scenarios, and the TAP does not see it as the obvious best choice. The TAP believes that further evaluation of capacity accreditation options is warranted before committing to use ELCC.

ELCC calculations are very time-consuming and nuanced. Decisions on average versus marginal ELCC and how to best represent both saturation effects and portfolio effects need to be considered. Heuristic approaches may give a similar,

representative answer in much less time. In addition, the TAP recommends testing various bookend capacity credits in RESOLVE to understand how sensitive the model results are to this assumption.

The TAP suggests that rather than committing to ELCC, ELCC should be compared to other approaches (mentioned below) by running selected simulations and comparing costs, resource mixes, and time to produce result. Based on that comparison, the approach that produces the least-cost adequate mix should be used (subject to a system-level minimum reliability standard / maximum risk metric such as LOLE, NEUE, etc). If two or more approaches result in resource costs that differ by an amount smaller than the uncertainties in those cost estimates, the more time-efficient approach can be selected.

Regarding iterations between GNA and system security: The TAP feels it should be possible to define a set of possible mitigation methods and the likely degrees of iteration that each method would require before the August GNA filing deadline. The TAP can help with this.

Regarding re-incorporation of inertia- and FFR-related criteria in the GNA: The TAP believes it should be possible to incorporate new constraints into the capacity planning and resource scheduling steps of the GNA that approximately capture the ability of each type of resource to provide emerging grid security-related services such as inertia, inertia-like services, and FFR. There is currently no consensus on exactly what those services should be, how to approximately quantify the ability of different resource types to provide those services, or how to determine the minimum threshold of each service needed for grid security. However, incorporation of approximate thresholds for services with approximate capabilities assigned to different resource types will probably increase the likelihood that the GNA selects a resource mix and dispatch scenarios that meet system security needs, thereby hopefully reducing the need for iterations of the GNA. That said, it has not been proven that such an approach is superior to one that omits system security-based constraints from capacity planning and production cost models, or to other approaches to incorporating system security into capacity planning and resource adequacy, so the GNA should be permitted to try various approaches rather than tying it to one single approach (e.g. virtual inertia and FFR). The TAP can work with HECO to suggest and evaluate different services similar virtual inertia and FFR for use in the GNA. The TAP will be happy to discuss this further with HECO.

Detailed Notes

Note's from the discussion are presented below along with some of HECO's slides for context.

HECO: summary of PUC order:

Recent Commission Orders Issued June 30, 2022

- Stage 3 RFP Order
  - File a Near-term Grid Needs Assessment for O'ahu and Maui within 30 days (July 29) and host a technical conference to discuss
- IGP Order
  - Approves the November 2021 Grid Needs Assessment Methodology Filing with modifications to the energy reserve margin and capacity accreditation with additional clarification, guidance on other issues
  - Approves ERM and exceedance-based HDC for this round of IGP only. Use of ERM/HDC outside of IGP requires PUC approval, and not for use in any other docket or filing (i.e., AOS, KPP transition plans).
  - Agrees with approach to add probabilistic analysis IGP process, including 250 draws and calculation of LOLP, LOLE, LOLH, and EUE. Future iterations should integrate climate change into its weather modeling.
  - Instructs Hawaiian Electric to develop an ELCC-based resource adequacy criteria for use in future rounds of IGP and develop a workplan in consultation with the TAP and Parties. The workplan must explain:
    - How Hawaiian Electric intends to solicit and incorporate stakeholder feedback
    - How long Hawaiian Electric expects the process to take
    - How and in what dockets and other efforts Hawaiian Electric uses ERM and HDC as resource adequacy criteria
    - How Hawaiian Electric could begin transitioning from using ERM and HDC to ELCC in IGP and elsewhere
    - How long it would take to compute ELCC for all resource types evaluated in PLEXOS as part of Hawaiian Electric's stochastic reliability modeling in the current round of IGP
    - File this workplan by August 31, 2022
  - Directs Hawaiian Electric to communicate to the Commission and stakeholders when the TAP's recommendations for future IGP processes will be implemented, file future written recommendations and advice from the TAP, as they are received, in this docket.

IGP Order: Impact of System Security Analysis on Resource Plans

- Hawaiian Electric's practical approach to adjusting the resource plan for transmission planning criteria violations remains unclear.
- The Commission shares Ulupono's concerns regarding the proper use of the optimization models in the grid needs assessment process. More explanation is needed for the magnitude of violations that would trigger an iteration in the prior modeling steps and how an addition or adjustment to the resource plan or production simulation would be sized appropriately to meet the violation.
- Commission directs Hawaiian Electric to clarify the magnitude and number of violations that would trigger a model iteration for another step in the GNA process. Must also clarify how it will use the modeling tools to continue to optimize the resource plan after an iteration. Provide written explanation in the Final GNA methodology.
- Directs Hawaiian Electric to promptly communicate with the Commission and stakeholders when modeling iterations occur as a result of not meeting certain criteria from any modeling step. At a minimum, this communication must include an IGP working group meeting open to all stakeholders, such as the STWG, and be filed in writing in this docket and posted on the IGP website.
- The Commission directs Hawaiian Electric to prepare methods to reincorporate virtual inertia and fast frequency response in the optimization tool used to develop resource plans in future iterations of IGP.

IGP Order: Regulating Reserve Criteria

- Commission is satisfied with the clarity regarding the methods used to determine regulating reserve requirements. However, Hawaiian Electric must better justify the standard deviation approach it will use to determine the regulating reserves for each island.
- Hawaiian Electric has not yet responded to stakeholder feedback regarding the decision to use three standard deviations.
- The Commission further directs Hawaiian Electric to conduct the additional analysis of the regulating reserve requirements recommended by Ulupono to arrive at the desired percentile for calculating regulating reserves instead of the 3-sigma calculation and use this result to implement "the best combination of high reliability and low reserve requirements" in the next round of IGP.
- Directs Hawaiian Electric to continue its review of this framework with stakeholders and the TAP to determine if there is a need to cap regulating reserve requirements in future rounds of IGP.

IGP Order: Transmission REZ Study

- Commission is concerned about the accuracy of these costs and implications on the model outcomes. To address these concerns, the Commission directs Hawaiian Electric to test the sensitivity of the transmission costs inputs in RESOLVE resulting from the REZ study.
- Further improvements that Hawaiian Electric must make to future iterations of the REZ study include: (1) following the TAP's recommendations to incorporate behind-the-meter DERs; (2) creating stepwise supply curves for each group; (3) incorporating non-Transmission alternatives; and (4) conducting additional transmission studies.
- Commission also directs Hawaiian Electric to consider the TAP's recommendation to use a chronological modeling tool, such as PLEXOS, to perform the dispatch analysis necessary to evaluate real-life scenarios and estimate transmission-related costs more accurately in future iterations of the REZ study.
- Hawaiian Electric must propose a community engagement plan for REZ development. This plan should clearly define how results from community engagement will inform REZ constraints and how these constraints will modify the results of the study. This plan will require Hawaiian Electric to clearly present technical information in a way that all stakeholders can easily comprehend, as discussed throughout this order. The Commission will monitor this process as it progresses before approving the results.

- HECO: Currently no transmission nodes built in PLEXOS

Discussion on ELCC and alternatives

Discussion

- ERM/HDC vs. PRM/ELCC in capacity expansion; probabilistic in PLEXOS
  - Given the thorough probabilistic analysis conducted, will the change to PRM/ELCC significantly impact results?
  - Calibrating ERM did not impact resource mix or lead to less build of hybrid solar; however, the firm generation amount did vary
  - Appropriate type analysis for adequacy of supply or other reliability assessments?

- HECO: Since we don't have a market, do we expect benefit of ELCC will outweigh time cost, given we are already doing probabilistic RA?
- TAP member: Probabilistic RA gives enough confidence in adequacy. ERM approach is a step forward relative to ELCC if HDC can be replaced with an more equitable approach. ELCC will take a lot longer, probably need to find a faster tool than PLEXOS, or use heuristic.
  - HECO: Resource mix selected by RESOLVE is not very sensitive to inputs. It always selects lots of PV+BESS
  - TAP member (via email): See attached for a slide deck I presented at the NERC Probabilistic Assessment Forum last fall that discusses ERM vs PRM (some familiar faces in the examples at

the end… and this was before I had joined the TAP!). What I refer to there as time-varying UCAP for thermal units is equivalent to what another TAP member is calling hourly expected capacity.

- NREL report comparing multiple different capacity credit heuristics with EFC (particularly section 4) https://www.nrel.gov/docs/fy21osti/80486.pdf .
- NREL report comparing EFC with the capacity credit heuristic used with PRMs in RPM (ReEDS, another NREL tool, uses a similar approximation, although with fewer peak net load hours): https://www.nrel.gov/docs/fy21osti/72472.pdf
- Anecdotally, in RPM (NREL tool) we've seen storage capacity credit approximations stop working well at higher levels of renewables (forcing us to compensate by cranking up the PRM to get adequate systems), which is one reason I'm such a proponent of using ERM instead. I don't think we've published anything about that though.
- Those reports both focus on EFC, not ELCC, but since you're not modeling transmission constraints (I think?) I would expect the two metrics to be more or less equivalent.
- I'm in the middle of some work looking at the model runtime implications and cost reduction benefits of ERM (using expected capacities and dynamic risk period selection) vs PRM and capacity credits, but unfortunately I don't have any numbers I can share yet. I should have results to share in the next month or two.

- TAP member: Agree with the previous TAP member's general summary. Ex-post probabilistic analysis (i.e. after the portfolio selection) is the most important way to check adequacy of portfolios selected by RESOLVE. However, RESOLVE needs to be seeded with a firm capacity credit by resource and a reliability target.
  - ELCC is very time consuming. ERM + HDC heuristic can give very close to same answer with much less time.
  - Agree with HECO that the model will not be sensitive to this assumption for what renewables get built. However, it will be a very important assumption determining how much capacity can be retired and the contribution of storage. But there are other ways to determine how much storage is needed (i.e. probabilistic analysis) given certain levels of retirements. Recommend developing a thermal unit retirement plan.
  - Summary of work going on on this topic:
    - I am leaning towards an average contribution during peak risk periods (ESIG example – HECO has; not public yet; cite with "Telos Energy / ESIG Redefining Resource Adequacy Task Force" or something similar)
    - California Slice of Day: Nick Pappas has a good summary of the CPUC RA Proposals.
    - NYISO (GE) is proposing a Marginal Reliability Improvement (MRI)
    - MISO is proposing a blended evaluation of past and future contributions during risk periods.
    - See attachments
- TAP member: Which docket are we talking about?
  - HECO: PUC made clear request for ELCC is for future work, not near-term GNA.
  - TAP member: Agree that it can be hard to calculate ELCC. A simplified approach can have merit. For example, reporting the average output from each resource class during shortfall hours would give a direct estimate of marginal ELCC for each resource. Need iteration between RESOLVE and resource adequacy stage. You know my concerns on ERM and HDC. They can work if using hourly expected capacity for each resource. Not sure what method will work best, but can compare different methods (three approaches) on cost.
  - TAP member suggests **comparing three capacity-forcing approaches**:
    - (From chat)
    - 1. ERM/HDC: pretty much as currently proposed: assign HDC to each resource class as well as possible, then require RESOLVE to choose resources whose HDC adds up to meet load plus ERM in

each hour. Test the capacity plan in a resource adequacy model. If there are too many or too few shortfalls, adjust ERM for that year. Repeat until right adequacy level is achieved.

- 2. PRM/ELCC: run RESOLVE without the ERM/HDC elements; instead assign a capacity credit (ELCC) to each class of resource each year and a capacity target (PRM) to meet each year. RESOLVE is required to add enough resources to meet the PRM each year. After each RESOLVE run, the portfolio is tested in a resource adequacy model. If there are too many or too few shortfalls in a given year, PRM for that year is adjusted. ELCC for each generator class in each year is calculated in the resource adequacy model, possibly as the average output from that class during shortfall hours in that year. The updated ELCC's and PRMs are put into RESOLVE and it is run again. This should converge eventually to a point where ELCC of each generator class in the resource adequacy study matches the ELCC being used in RESOLVE.
- 3. ERM/Hourly Expected Capacity (HEC): similar to ERM/HDC, but HDC is replaced with HEC. For intermittent projects, HEC is calculated as the expected availability of each wind/solar project in each hour of each sample day (same as the profiles used for the economic optimization). For thermal plants and storage, HEC is nameplate capacity derated by forced outage rate for that type of generator. Storage would be used to store energy and redeliver at appropriate times. All of this is identical to the main optimization that RESOLVE does (or should do), but it would be dispatched to meet load + ERM instead of just load. Extra care would be taken to include the worst weather days in the sample set, but this may not be essential. Test the capacity plan in a resource adequacy model. If there are too many or too few shortfalls, adjust ERM for that year. Repeat until right adequacy level is achieved. (May need to set ERM separately for each year.)
- All of these methods iterate between the capacity model and the resource adequacy model, cranking the ERM or PRM up until adequacy is achieved. (They may also propagate some extra information back, e.g., ELCC values). So all of them can provide an adequate plan. So one option would be to try all three and see which gives the best plan (lowest cost for an adequate level of reliability). This also somewhat addresses the PUC's question about when another iteration is needed: they seem to assume each iteration is done to address a failure of the process, but actually iterations are just a built-in part of the process, used to harmonize capacity and adequacy models. And iterations continue until the right level of adequacy is achieved.
- This is summarized in a slide deck shared via email by this TAP member.

- TAP member: I'd support approach #3: (ERM + expected capacity) over (PRM+ELCC). The only other improvement I would suggest would be to dynamically add ERM dispatch days based on risk periods identified in the probabilistic RA step from the previous iteration… But as the other TAP member says, even without that you can still force the system to be adequate (just maybe less cost-optimal) with a less strategic choice of periods by just cranking up the ERM instead.
  - Another TAP member agrees, and adds: PRM+ELCC may bias the mix in the opposite direction from ERM+HDC if worst weather days are not included.
- TAP member: Maybe we do need thermal capacity close to peak load, but want to prove it.
- HECO: We've tried adjusting capacity credits in RESOLVE. Can share results later

- TAP member: All methods have assumptions. None is perfect, but some may provide more transparency and basis to their assumptions than others. Like the idea of comparing methods if there is time, or at least more detailed thinking through of what the differences are likely to be in RESOLVE outputs.
  - HECO: we will try to find time to compare the three methods
  - Another TAP member: even before that, you can adjust capacity credit given to storage in RESOLVE to see sensitivity
  - HECO: before settling on ELCC, will compare to other methods
- TAP member: What about classifying resources by type of capacity required?
  - Another TAP member: Good idea.
    - To follow-up on the heuristic discussion... MISO is potentially going to switch to a Capacity Credit during tight margin and LOL hours

- https://www.misoenergy.org/link/23187c720fdd4a33b78e86f355320b26.aspx?epslanguage=en
- Also looking at other approaches
- ELCC is current best practice in most regions, but California and Hawaii are moving away from it, so alternatives should be evaluated

▪ TAP member: can you elaborate?
  - TAP member: look at hourly unserved energy hours. Look at average output of each resource during loss-of-load hours:

An illustrative example: solar

System Unserved Energy

Hour of Year	Weather Year 1			Weather Year 2		
	Sample 1	Sample 2	Sample N	Sample 1	Sample 2	Sample N
1	0	0	0	10	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	20	0	0	0	0	0
5	40	0	0	0	30	0
6	10	0	0	0	10	0
7	0	0	0	0	5	0
8	0	0	0	0	2	0
9	0	0	0	0	1	0
10	0	0	0	0	0	0
...	0	0	6	0	0	0
8758	0	0	10	0	0	0
8759	0	0	2	0	0	0
8760	0	0	0	0	0	0

Two weather years, 6 outage samples
LOLE = 0.67 days/year
LOLH = 2 hours/year
EUE = 24.3 MWh/year

Generator Availability*
(installed capacity = 10 MW)

Hour of Year	Weather Year 1			Weather Year 2		
	Sample 1	Sample 2	Sample N	Sample 1	Sample 2	Sample N
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	1	1	1	0	0	0
4	4	4	4	2	2	2
5	8	8	8	3	3	3
6	3	3	3	1	1	1
7	1	1	1	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	1	1	1	2	2	2
...	5	5	5	6	6	6
8758	10	10	10	0	0	0
8759	6	6	6	6	6	6
8760	3	3	3	1	1	1

Average out during events = 3.33 MW
Nameplate Capacity = 10 MW
Capacity Accreditation = 33%

▪ TELOS ENERGY www.telos.energy 6
▪ TAP member: This approach has lots of assumptions too.
▪ TAP member: Agreed. What I like is that you can do this for every class of resource.

Discussion on interation between GNA and security studies

- System Security
  - How to quantify shortfalls?
  - How best to integrate FFR and inertia constraints in a capacity expansion model given grid forming inverters?
  - What is the threshold for RESOLVE iterations e.g. above a certain quantity of firm or synchronous condensers that need to be added? Is it more meaningful to iterate on the PLEXOS production simulation instead of all the way back to RESOLVE?

-
  - TAP member: Perhaps we can classify violations into ones that require minor changes vs ones that require a change in resource mix.
  - TAP member: ESIG starting an effort to look at capacity expansion models to improve them for transmission planning users. PSO does N-1 in capacity expansion.

- TAP member: Can capacity expansion tool report on depth/shallowness of resource mix? Can it (e.g. RESOLVE) tell you what axes have high impact on cost vs what axes have no impact on cost? I.e. changes are sensitive. E3 is included in the project.
    - HECO: RESOLVE just gives one plan. Some other tools give multiple options.
- TAP member: On FFR and inertia
    - In RESOLVE-PLEXOS-stability loop, try to just iterate back one level if that can fix the
- HECO: Maybe we can list potential mitigations? TAP member: Yes, and list likely mitigations of each, and what step(s) may be iterated.
    - TAP member: how hard is it to iterate? HECO: Not hard, just takes time.
    - TAP member: Agreed iterates are time-intensive. Industry needs to improve linkages between tools. Important to test resource mixes as you go.
    - TAP member: Can you use different PLEXOS-based tools for multiple steps in process?
    - TAP member: Agree. We are working with Energy Exemplar in linking PLEXOS to PSSE, and in a broader effort (Integrated Strategic System Planning) to link different modeling domains. That is resulting in a number of screening criteria for when to pass info between models and what to pass, as well as tools to screen from PCM->PF and CEM->PCM.
- HECO: How can we capture FFR and inertia needs in RESOLVE?
    - TAP member: Need to understand types of resources and how much stability they give. Can maybe give GFM resources a MW-s value approximation. Create threshold for minimum effect inertia based on highest risk scenarios.
    - TAP member: Agree:
    - TAP member: We have some past work on this.
    - TAP member: Keep inertia separate from FFR.
    - TAP member (in chat, with later clarifications): About inertia, short-circuit current, etc.: Those could probably be handled similarly to the PRM/ELCC approach above. If you find you fall short of these services in the resource adequacy study or system stability study, you could set a target for that service in RESOLVE and assign each resource a credit toward that target based on its performance in the production cost model and the dynamic stability model. (To do this right, you need to include the capabilities of grid-forming inverters, which was the main concern about the previous version of these targets.)
        - TAP member: I'm not aware of a way to verify system stability in a production cost model on the timescales relevant to grid-forming/inertia/short-circuit current. This would likely need to be done in dynamic software (PSSE or, more likely, PSCAD). A production cost model could set a target for each stability service, similar to RESOLVE, which would increase the likelihood of the ProdCost selecting stable/secure dispatches, which would then be verified in PSSE/PSCAD and iterated if needed.
    - TAP member: Can you experimentally define the "effective inertia" or "effective FFR" of a resource based on simulations?
        - TAP member: Maybe. Hopefully can at least approximate. Still need PSSE/PSCAD as final go-no-go.
    - HECO: Won't effective inertia/FFR needs change over time? TAP member: Not necessarily. Could change based on changes in worst-case events.
    - HECO: Re virtual inertia: GFM is very different from sync machines. Vendors will have very different MW-s values. Need to make sure in high-IBR system we have enough voltage-forming sources. May not be ready to do this today.
        - TAP member: Want to see more details of these concerns. There are many voltage support options. HECO: GFM capacity gets taken up by voltage events. TAP member: Power and reactive power are in quadrature. Can get both at the same time to some extent.

- TAP member: do you require Q at full P? HECO: yes, in steady-state. Stage 3 requires short-term overcurrent capability. TAP member: Short-term overcurrent is possibly yet another category of system need.
- TAP member: The idea of including a rough approximation of the voltage-forming capacity and other potential stability/security services is to bring the GNA closer to a stable/secure dispatch. This would of course still need to be verified in dynamic software, currently in the EMT domain.
- TAP member: Voltage-forming capacity may be a better metric/service than inertia or virtual inertia, because it better captures what sync machines and GFM inverter have that GFL inverters don't have. It should probably not be the only metric though. Others could be fast active power response (e.g. FFR) and maybe fault current capacity. More work is needed to determine the best services/metrics need to ensure stability and operability of a high-IBR system.

- TAP member: Have you tested putting inertia and FFR requirements in the GNA?
  - HECO: The past FFR requirement didn't drive much difference in RESOLVE output. Inertia impacted RESOLVE choices. We only looked at physical inertia at that time.
    - TAP member (later via email): Might be worth checking the ISP methodology in Australia. Their approach may be different, but it's worth reading.
      - AEMO includes power system constraints (e.g., number of large synchronous units online in each region) in the ST model (not LT). LT-ST interaction is shown on page 12 of 2021-isp-methodology.pdf (aemo.com.au).
      - Note that the numbers of large synchronous units online per region AEMO use are high-level planning assumptions (not operational advice). When assessing system strength and inertia shortfalls, the requirement to always keep minimum units online is relaxed in ST in order to determine timing and size of potential shortfalls.
      - The status of all synchronous units (on/off) is extracted from ST output that is applied to the PSSE model to assess system strength and inertia levels. The steps are listed on page 22 and 24 of appendix--9.pdf (aemo.com.au).
  - TAP member: A concern with the previous inertia requirement was that it didn't give credit to GFM.
- TAP member: Also need to consider PSSE vs PSCAD stability analysis capabilities

Hawaiian Electric

IGP Technical Advisory Panel

July 7, 2022

Agenda

- Review IGP and Stage 3 RFP Orders

Recent Commission Orders Issued June 30, 2022

- Stage 3 RFP Order
  - File a Near-term Grid Needs Assessment for O‘ahu and Maui within 30 days (July 29) and host a technical conference to discuss
- IGP Order
  - Approves the November 2021 Grid Needs Assessment Methodology Filing with modifications to the energy reserve margin and capacity accreditation with additional clarification, guidance on other issues
  - Approves ERM and exceedance-based HDC for this round of IGP only. Use of ERM/HDC outside of IGP requires PUC approval, and not for use in any other docket or filing (i.e., AOS, KPP transition plans).
  - Agrees with approach to add probabilistic analysis IGP process, including 250 draws and calculation of LOLP, LOLE, LOLH, and EUE. Future iterations should integrate climate change into its weather modeling.
  - Instructs Hawaiian Electric to develop an ELCC-based resource adequacy criteria for use in future rounds of IGP and develop a workplan in consultation with the TAP and Parties. The workplan must explain:
    - How Hawaiian Electric intends to solicit and incorporate stakeholder feedback
    - How long Hawaiian Electric expects the process to take
    - How and in what dockets and other efforts Hawaiian Electric uses ERM and HDC as resource adequacy criteria
    - How Hawaiian Electric could begin transitioning from using ERM and HDC to ELCC in IGP and elsewhere
    - How long it would take to compute ELCC for all resource types evaluated in PLEXOS as part of Hawaiian Electric’s stochastic reliability modeling in the current round of IGP
    - File this workplan by August 31, 2022
  - Directs Hawaiian Electric to communicate to the Commission and stakeholders when the TAP’s recommendations for future IGP processes will be implemented, file future written recommendations and advice from the TAP, as they are received, in this docket.

IGP Order: Impact of System Security Analysis on Resource Plans

- Hawaiian Electric's practical approach to adjusting the resource plan for transmission planning criteria violations remains unclear.
- The Commission shares Ulupono's concerns regarding the proper use of the optimization models in the grid needs assessment process. More explanation is needed for the magnitude of violations that would trigger an iteration in the prior modeling steps and how an addition or adjustment to the resource plan or production simulation would be sized appropriately to meet the violation.
- Commission directs Hawaiian Electric to clarify the magnitude and number of violations that would trigger a model iteration for another step in the GNA process. Must also clarify how it will use the modeling tools to continue to optimize the resource plan after an iteration. Provide written explanation in the Final GNA methodology.
- Directs Hawaiian Electric to promptly communicate with the Commission and stakeholders when modeling iterations occur as a result of not meeting certain criteria from any modeling step. At a minimum, this communication must include an IGP working group meeting open to all stakeholders, such as the STWG, and be filed in writing in this docket and posted on the IGP website.
- The Commission directs Hawaiian Electric to prepare methods to reincorporate virtual inertia and fast frequency response in the optimization tool used to develop resource plans in future iterations of IGP.

IGP Order: Regulating Reserve Criteria

- Commission is satisfied with the clarity regarding the methods used to determine regulating reserve requirements. However, Hawaiian Electric must better justify the standard deviation approach it will use to determine the regulating reserves for each island.
- Hawaiian Electric has not yet responded to stakeholder feedback regarding the decision to use three standard deviations.
- The Commission further directs Hawaiian Electric to conduct the additional analysis of the regulating reserve requirements recommended by Ulupono to arrive at the desired percentile for calculating regulating reserves instead of the 3-sigma calculation and use this result to implement "the best combination of high reliability and low reserve requirements" in the next round of IGP.
- Directs Hawaiian Electric to continue its review of this framework with stakeholders and the TAP to determine if there is a need to cap regulating reserve requirements in future rounds of IGP.

IGP Order: Transmission REZ Study

- Commission is concerned about the accuracy of these costs and implications on the model outcomes. To address these concerns, the Commission directs Hawaiian Electric to test the sensitivity of the transmission costs inputs in RESOLVE resulting from the REZ study.
- Further improvements that Hawaiian Electric must make to future iterations of the REZ study include: (1) following the TAP's recommendations to incorporate behind-the-meter DERs; (2) creating stepwise supply curves for each group; (3) incorporating non-Transmission alternatives; and (4) conducting additional transmission studies.
- Commission also directs Hawaiian Electric to consider the TAP's recommendation to use a chronological modeling tool, such as PLEXOS, to perform the dispatch analysis necessary to evaluate real-life scenarios and estimate transmission-related costs more accurately in future iterations of the REZ study.
- Hawaiian Electric must propose a community engagement plan for REZ development. This plan should clearly define how results from community engagement will inform REZ constraints and how these constraints will modify the results of the study. This plan will require Hawaiian Electric to clearly present technical information in a way that all stakeholders can easily comprehend, as discussed throughout this order. The Commission will monitor this process as it progresses before approving the results.

Discussion

- ERM/HDC vs. PRM/ELCC in capacity expansion; probabilistic in PLEXOS
  - Given the thorough probabilistic analysis conducted, will the change to PRM/ELCC significantly impact results?
  - Calibrating ERM did not impact resource mix or lead to less build of hybrid solar; however, the firm generation amount did vary
  - Appropriate type analysis for adequacy of supply or other reliability assessments?
- System Security
  - How to quantify shortfalls?
  - How best to integrate FFR and inertia constraints in a capacity expansion model given grid forming inverters?
  - What is the threshold for RESOLVE iterations e.g. above a certain quantity of firm or synchronous condensers that need to be added? Is it more meaningful to iterate on the PLEXOS production simulation instead of all the way back to RESOLVE?

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF HAWAI'I

In the Matter of PUBLIC UTILITIES COMMISSION Instituting a Proceeding To Investigate Integrated Grid Planning.	DOCKET NO. 2018-0165

CERTIFICATE OF SERVICE

I hereby certify that I have on this date copies of the foregoing *Motion for Clarification and/or Partial Reconsideration of Order No. 38482, Memorandum in Support of Motion and Exhibit 1*, together with this Certificate of Service, upon the following, by causing a copy hereof to be served by electronic mail, as set forth below:

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DATED: Honolulu, Hawai‘i, July 11, 2022.

HAWAIIAN ELECTRIC COMPANY, INC.

_/s/Marisa Chun_____
Marisa Chun

Chun, Marisa

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